

MENU

SEARCH

INDEX

DETAIL

JAPANESE

1 / 1

## PATENT ABSTRACTS OF JAPAN

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MINAMITANI RINTARO  
NAKAGAWA TAKESHI

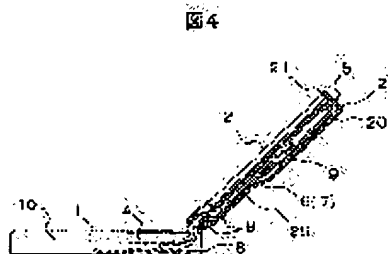
## (54) ELECTRONIC EQUIPMENT

## (57)Abstract:

PROBLEM TO BE SOLVED: To provide a liquid cooling structure wherein it assures a circulated fluid flow rate necessary and sufficient for an increase in the quantity of heat generation of a heating device followed by an improvement in the throughput capacity of electronic equipment, and is suitable for being reduced in size and thickness, and further provide the electronic equipment durable for a long-term use.

SOLUTION: The electronic equipment is adapted such that it thermally connects a heat receiving jacket 4 to a heating device 3, and further thermally connects a tank 5, a pipe 6, a pipe 7, and a heat sink panel 25 all disposed on the back of a display

2. A refrigerant fluid is circulated between the heat receiving jacket 4 and a pipe 9 with



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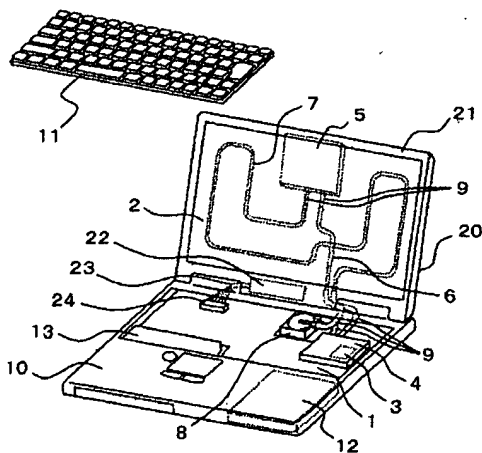
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DRAWINGS

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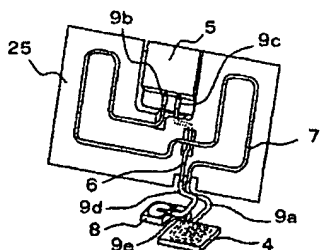
[Drawing 1]

図1

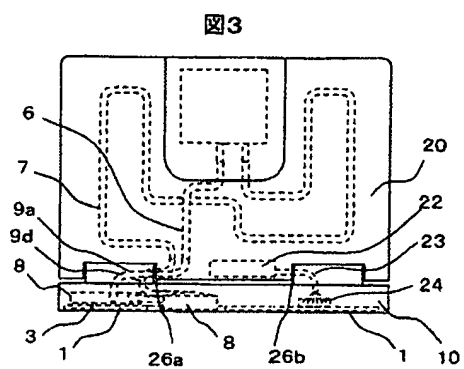


[Drawing 2]

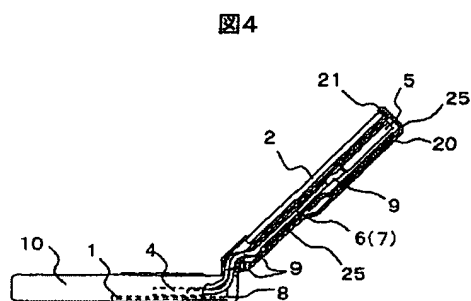
図2



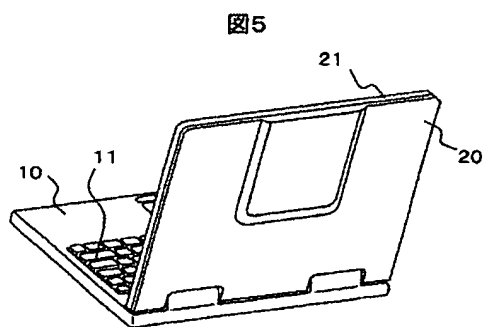
[Drawing 3]



[Drawing 4]

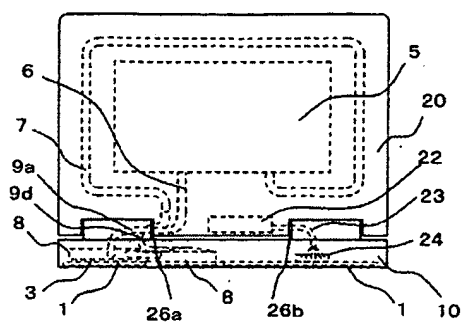


[Drawing 5]



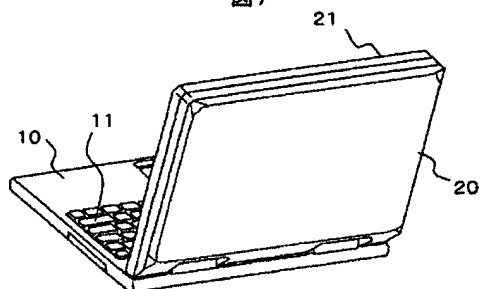
[Drawing 6]

図6



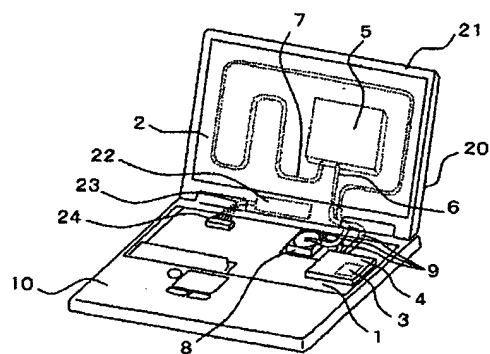
[Drawing 7]

図7



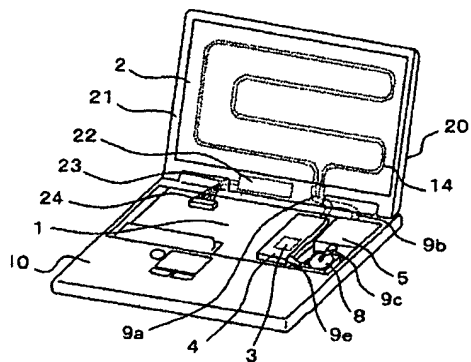
[Drawing 8]

図8



[Drawing 9]

図9



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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]

This invention relates to the electronic instrument carrying the cooling system which used the liquid as the heat dissipation medium.

[0002]

[Description of the Prior Art]

In recent years, as for the electronic instrument, high generation-of-heat-ization of a semiconductor device is progressing as the demand of improvement in the speed or large-capacity-izing becomes high. JP,6-266474,A, JP,7-142886,A, etc. are raised as a cooling means corresponding to this raise in generation of heat.

[0003]

the body case which held the wiring substrate in which the electronic instrument indicated by JP,6-266474,A carried the heater element, and a display panel -- having -- a body case -- a hinge -- rotation -- it consists of a display case attached movable. A heat-receiving jacket is attached in a heater element, and the liquid which endoergic was carried out with this heat-receiving jacket, and got hot radiates heat from the heat dissipation pipe installed in the display case. It circulates through a liquid with the liquid drive attached in the middle of the piping path which connects a heat dissipation pipe with heat-receiving JAKKETO. Piping which connects a part for a hinge region serves as a flexible tube. Furthermore, JP,7-142886,A aims at improvement in the heat dissipation effectiveness by making the case of JP,6-266474,A into metal.

[0004]

Refrigeration capacity is high, and moreover these conventional techniques are excellent in silence, and more effective in cooling of an electronic instrument than forced cooling by the fan.

[0005]

[Problem(s) to be Solved by the Invention]

A raise in generation of heat of the component according to improvement in the engine performance with the electronic instrument represented by the pocket mold personal computer etc. is remarkable. On the other hand, the miniaturization of case size suitable for a cellular phone and thin shape-ization are desired.

[0006]

Although the above-mentioned conventional technique is effective in cooling of an electronic instrument, it needs to perform still more reliable cooling for cooling of the electronic instrument which may be thin-shape[ small and ]-ized increasingly from now on.

[0007]

The purpose of this invention is to offer the electronic instrument which adopted reliable liquid cooling.

[0008]

[Means for Solving the Problem]

In the electronic instrument equipped with the 1st case with which the above-mentioned purpose attached the heater element, and the 2nd case which rotation support is carried out with two or more hinges at this 1st case, and has a drop The heat-receiving jacket connected to said heater element, and the heat dissipation pipe attached in said 2nd case, The heat sink attached in this heat dissipation pipe, and the tank attached in this heat sink, It comes to have the liquid driving means which is attached in said 1st case and transports the liquid in said tank to said heat-receiving jacket, and said two or more hinges are attained by being the 1st hinge which lets piping to which said liquid is transported pass, and the 2nd hinge which lets the electric wire from said indicator pass.

[0009]

Again. The direction of the distance which said liquid comes out of the above-mentioned purpose from said heat-receiving jacket rather than the distance to which said liquid comes out of said tank, passes said liquid driving means, and reaches even said heat-receiving jacket, and reaches even said tank is attained by the \*\*\*\*\*.

[0010]

Moreover, in said heat sink, the above-mentioned purpose is attained, when the display case made of wrap resin forms the rear face of said 2nd case.

[0011]

Moreover, the above-mentioned purpose contains said tank in said 1st case, and is attained by that the heat dissipation pipe in said 2nd case is flat.

[0012]

Moreover, the above-mentioned purpose is attained by having doubled the depth of said display case with the thickness of said tank.

[0013]

Moreover, the above-mentioned purpose is attained by having considered as the location nearest to the hinge with which liquid piping passes along said tank.

[0014]

Moreover, the above-mentioned purpose is attained by having covered said tank by said heat sink, and having covered this heat sink in the display case.

[0015]

[Embodiment of the Invention]

By the way, the technique which cools the semiconductor device in an electronic instrument with a liquid was performed by the large-sized computer which is performed from the former, for example, is used in the bank or the company. The cooling system of a large-sized computer makes a semiconductor device circulate through a lot of liquids with a pump, and radiates heat compulsorily with the heat radiator of dedication installed in the outdoors etc. in the liquid which carried out endoergic from the semiconductor device and got hot.

[0016]

The most important thing in the case of carrying a cooling system with this liquid in electronic equipment (application to the device which produces generation of heat, such as not only a personal computer but television, a liquid crystal projector, an electronic cooking machine, etc., being possible) is safe.

[0017]

First of all, although a feeling of resistance is for moisture to permeate [ itself ] into an electronic instrument, since a package of a pump, a heat-receiving jacket, flexible piping, and a heat dissipation jacket is contained, it is necessary to isolate piping and electric wiring at least as much as possible.

[0018]

Then, this invention explains the result of having examined many things about the safety aspect at the time of carrying a cooling system with a liquid in an electronic instrument, in the following examples.

[0019]

(Example 1)

Drawing 1 is the perspective view of the electronic instrument equipped with the 1st this example.

In drawing 1 , an electronic instrument consists of a body case 10 and a display case 20 equipped with the display 2, and the keyboard 11 installed in the body case 10, the Main wiring substrate 1 in which two or more components were carried, a hard disk drive 12, and auxiliary storage unit (for example, floppy disk drive, CD drive, etc.) 13 grade are installed. On the Main wiring substrate 1, the connector 24 grade for the electrical signals to the component (the following, CPU, and publication) and display 2 especially with large calorific value of CPU(central processing unit) 3 grade is carried. In addition, the keyboard 11 shows the condition of having removed, for explanation.

A display 2 is contained by the display case 20 by the display frame 21.



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MEANS

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[Means for Solving the Problem]

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[Embodiment of the Invention]

By the way, the technique which cools the semiconductor device in an electronic instrument with a liquid was performed by the large-sized computer which is performed from the former, for example, is used in the bank or the company. The cooling system of a large-sized computer makes a semiconductor device circulate through a lot of liquids with a pump, and radiates heat compulsorily with the heat radiator of dedication installed in the outdoors etc. in the liquid which carried out endoergic from the semiconductor device and got hot.

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A display 2 is contained by the display case 20 by the display frame 21. The wiring substrate 22 for a display is installed in the display 2 bottom, and the wiring substrate 22 for a display is connected with the connector 24 on the Maine wiring substrate 1 by the electric wire 23 in electrical signal at it.

[0020]

The heat-receiving jacket 4 is attached in CPU3, and CPU3 and the heat-receiving jacket 4 are a flexible heat-conduction member (for example, thing which mixed thermally conductive fillers, such as oxidation aluminum, in Si rubber.). however -- not illustrating -- it minds and connects. Moreover, the display 2 was supported in the display frame 21 and the display case 20, the tank 5, the tank outlet side pipe 6, and the tank entrance-side pipe 7 were installed between the display 2 and the display case 20, and refrigerant liquid (for example, water, the antifreezing solution, etc.) is contained in this tank 5.

[0021]

Moreover, the pump 8 which is a liquid transportation means is installed in the body case 10. It connects with a flexible tube 9, a tank 5, the tank outlet side pipe 6, the pump 8, the heat-receiving jacket 4, and the tank entrance-side pipe 7 have become the circulator of closed refrigerant liquid, and the refrigerant liquid enclosed with the interior by operation of a pump 8 circulates through them. The heat generated in CPU3 is told to the refrigerant liquid which circulates the inside of the heat-receiving jacket 4, and while passing the tank entrance-side pipe 7 installed in the tooth back of a display 2, a tank 5, and the tank outlet side pipe 6, it radiates heat in the open air through the front face of the heat dissipation panel 25 mentioned later and the display case 20. The refrigerant liquid with which temperature fell by this is again sent out to the heat-receiving jacket 4 through a pump 8.

[0022]

Drawing 2 is the perspective view of the components of passage through which the refrigerant liquid of the 1st example circulates.

In drawing 2, it circulates through refrigerant liquid by operating a pump 8 in order of the heat-receiving jacket 4, the tank entrance-side pipe 7, a tank 5, the tank outlet side pipe 6, and a pump 8.

A lightweight aluminium alloy with thermal conductivity sufficient [ the heat-receiving jacket 4 in this example ], The tank entrance-side pipe 7 and the tank outlet side pipe 6 are excellent in corrosion resistance. Stainless steel with sufficient thermal conductivity, Resin [ high intensity there is little moisture transparency and lightweight / a tank 5 ] (SPS: SHINJI nerd polystyrene), Complicated molding is easy for the case of the outside of a pump 8, and it is formed by resin (PPS: 40% of

polyphenylene-sulfide-resin + glass fibers) excellent in the mechanical strength. The flexible tubes 9a, 9b, 9c, 9d, and 9e which have connected each component are formed by isobutylene isoprene rubber. A display case is always opened and closed, and since isobutylene isoprene rubber is excellent in thermal resistance, shock resistance, and permeability-proof so that it may be represented by the tire tube of an automobile, it demonstrates the outstanding effectiveness like this example for cooling of the electronic equipment by which a liquid circulates.

Moreover, the tank entrance-side pipe 7 and the tank outlet side pipe 6 are installed in the heat dissipation panel 25 formed with aluminum, each is connected thermally and the heat sinking plane product is expanded.

[0023]

Moreover, the tank entrance-side pipe 7 is longer than the tank outlet side pipe 6, and the refrigerant liquid with which temperature fell has passage composition included in a tank 5.

It not only can radiate heat from a metal plating part, but furthermore the metaled thin film is plated by the front face of a tank 5, and it is aiming at reduction of the refrigerant liquid transparency from the tank 5 made of resin by this metal plating.

In addition, having made it the product made of resin adopted the tank 5 from lightweight being a thing and molding being comparatively easy.

[0024]

In addition, although the tank 5 was made into the product made of resin and the metal thin film was plated with this example on the front face, it is also possible to make the tank itself into metal and to prevent transparency of refrigerant liquid. When manufacturing a metal tank, it is possible to form in the edge of a metal cup in total a metal plate monotonous in the metal cup which extracted in the shape of a bowl and was cast (for example, almost the same as that of manufacture of elliptical canning).

[0025]

Drawing 3 is the rear view of the electronic instrument (condition which opened the display case 20) of the 1st example.

Hinge 26a and hinge 26b are the connections of the body case 10 and the display case 20, and the display case 20 can open now in drawing 3 and close the top face of the body case 10 with these hinges 26a and 26b.

[0026]

Flexible tube 9d which connects to hinge 26a flexible tube 9a which connects the tank outlet side pipe 6 and the heat-receiving jacket 8, and a pump 8 and the tank entrance-side pipe 7 passes. The pump 8 on the Maine wiring substrate 1 is located in the hinge 26a side. This shortens piping of the water within the body case 10 as much as possible, and considers insurance.

[0027]

In another hinge 26b, the electric wire 23 which connects the connector 24 on the wiring substrate 22 for a display and the Maine wiring substrate 1 in electrical signal passes.

Hinge 26a is making the hinge become independent according to the class of piping which lets the circulation path of refrigerant liquid, and hinge 26b pass like an electrical signal, or electric wire as mentioned above. This eliminates the factor which leads to electric accident as much as possible by distinguishing the field of the electric system along which electric wiring passes using two hinges, and the liquid field along which a liquid passes. In addition, in consideration of insurance, at least in the busy condition of electronic equipment, the FUREKISHIBU tube is designed so that it may not be located on a wiring substrate.

[0028]

Drawing 4 is a side elevation in the condition of having opened the display case 20 of the electronic instrument equipped with the 1st example.

In drawing 4, the tank outlet side pipe 6 and the tank entrance-side pipe 7 are installed in the heat dissipation panel 25, and are connected to the heat-receiving jacket 4 within the body case 10, the pump 8, and the tank 5 by the side of the display case 20 through the flexible tube 9. A display 2 is installed in the display frame 21, and the tooth back of a display 2 is covered with the display frame 21.

Furthermore, the display case 20 is attached in the display frame 21, and, thereby, the tank outlet side pipe 6, the tank entrance-side pipe 7, the tank 5, and the heat dissipation panel 25 are arranged between the display frame 21 and covering 20. Arrangement of the upper part of a display 2 is the order of a display 2, the display frame 21, a tank 5, the heat dissipation panel 25, and the display case 20. A tank 5 is covered by some heat dissipation panels 25, and this heat dissipation panel 25 is covered in the display case 20.

[0029]

By this, since the tank 5 is protected by the heat dissipation panel 25, even if an impact is added from the display case 20 side, a tank 5 will be protected by the heat dissipation panel 25.

[0030]

Drawing 5 is the perspective view seen from the tooth back in the condition of having opened the electronic instrument of the 1st example.

In drawing 5, the body case 10, the keyboard 11, the display case 20, and the display frame 21 are formed by resin.

Since especially the display case 20 has covered the tank 5 and the heat dissipation panel 25 which get hot while CPU3 is exoergic, the role is very large as protection from an operator's burn.

[0031]

(Example 2)

It is the rear view of the electronic instrument (condition which opened the display case 20) which equipped drawing 6 with the 2nd example.

In drawing 6, the basic configuration of this example is the example which carried out the tank 5 to the almost same \*\* as the example explained by drawing 5 from drawing 1 thinly, and extended area.

The tank entrance-side pipe 7 is longer than the tank outlet side pipe 6, heat is radiated through the heat dissipation panel 25, and the refrigerant liquid with which temperature fell has passage composition included in a tank 5. Moreover, hinge 26a has the composition that this example was also separated as a path of an electrical signal, as for the circulation path of refrigerant liquid, and hinge 26b.

[0032]

Drawing 7 is the perspective view which looked at the electronic instrument of the 2nd example stated by drawing 6 from the tooth back.

In drawing 7, by having made the tank 5 thin and having extended area, the swelling which avoided the tank 5 in the center section of the display case 20 as shown in drawing 5 is lost, and a design good in design is obtained.

Furthermore, since the heat dissipation effectiveness from part tank 5 confidence whose surface area of a tank 5 increases can be acquired, the bending number of a part and the tank entrance-side pipe 7 can be lessened and pipe 7 the very thing can be shortened, the rate of flow of a liquid can be improved.

Consequently, cooling effectiveness improves.

[0033]

(Example 3)

It is the perspective view of the electronic instrument which equipped drawing 8 with the 3rd example.

In drawing 8, a basic configuration shifts the location of the tank 5 which is almost the same as the example explained by drawing 5 from drawing 1, and is installed between the display 2 and the display case 20.

The location nearest to the hinge along which liquid piping passes as a location of the tank 5 to shift is effective. This can make the outlet side pipe 6 the straight minimum distance. Consequently, even if it compares with drawing 1, the rate of flow of the liquid separation object with which the bending parts of the entrance-side pipe 7 decrease in number becomes early, and the expenses electric energy of a pump can be reduced as a result so that it may understand.

[0034]

(Example 4)

Drawing 9 is the perspective view of the electronic instrument equipped with the 4th example, and is the example which installed the tank 5 in the body case 10.

In drawing 9 , the pipe 14 is formed with the metal and installed in the sandwiches condition between the display 2 and the display case 20. It connects with the heat-receiving jacket within the body case 10 through flexible tube 9a, and this pipe 14 is further connected to the tank 5 through flexible tube 9b. It connects with a heat-receiving jacket through flexible tube 9e, and the pump 8 is further connected to the tank 5 through flexible tube 9c.

By operating a pump 8, it circulates through refrigerant liquid in order of the heat-receiving jacket 4, a pipe 14, a tank 5, and a pump 8. It is cooled while refrigerant liquid passes through the inside of a pipe 14, and the refrigerant liquid with which temperature fell has passage composition included in a tank 5.  
[0035]

Thus, even if a tank 5 is installed in [ instead of between a display 2 and the play case 20 ] the body case 10, it can fully cool CPU3.

[0036]

In addition, although it is possible to make the display case 20 thin by arranging a tank 5 in the body case 10, in order to make it still thinner, it is good to use the pipe 14 by the side of the display case 20 as the flat pipe of an ellipse form. Since thin-shape-izing of the display case 20 is not only possible, but a touch area with a heat dissipation panel is expandable if it is made a flat pipe, the heat dissipation effectiveness increases.

[0037]

A tank 5 and a pump 8 are good as for one in covering of the front face which eliminates this flexible tube 9c and constitutes a tank 5 and a pump 8, although it connects by flexible tube 9c.

[0038]

Since the hinge region of the circulation path of refrigerant liquid and the hinge region along which an electric wire passes are separated and constituted like the above, even if refrigerant liquid should be revealed, an electric trouble can be prevented beforehand.

[0039]

Moreover, since the metal heat dissipation panel is covered in the display case made of resin and an operator does not touch a hot metal member directly, safety aspects, such as a burn, are also considered.

[0040]

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CLAIMS

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[Claim(s)]

[Claim 1]

In the electronic instrument equipped with the 1st case which attached the heater element, and the 2nd case which rotation support is carried out with two or more hinges at this 1st case, and has a drop, It comes to have the heat-receiving jacket connected to said heater element, the heat dissipation pipe attached in said 2nd case, the heat sink attached in this heat dissipation pipe, the tank attached in this heat sink, and the liquid driving means which is attached in said 1st case and transports the liquid in said tank to said heat-receiving jacket,

Said two or more hinges are electronic instruments characterized by being the 1st hinge which lets piping to which said liquid is transported pass, and the 2nd hinge which lets the electric wire from said indicator pass.

[Claim 2]

In an electronic instrument according to claim 1,

The electronic instrument with which the direction of the distance to which said liquid comes out of said heat-receiving jacket, and reaches even said tank rather than the distance to which said liquid comes out of said tank, passes said liquid driving means, and reaches even said heat-receiving jacket is characterized by the \*\*\*\*\*.

[Claim 3]

The electronic instrument characterized by the display case made of wrap resin forming the rear face of said 2nd case for said heat sink in an electronic instrument according to claim 1.

[Claim 4]

In an electronic instrument according to claim 1,

The electronic instrument which contains said tank in said 1st case, and is characterized by the heat dissipation pipe in said 2nd case being flat.

[Claim 5]

In an electronic instrument according to claim 1,

The electronic instrument characterized by doubling the depth of said display case with the thickness of said tank.

[Claim 6]

In an electronic instrument according to claim 1,

The electronic instrument characterized by considering as the location nearest to the hinge with which liquid piping passes along said tank.

[Claim 7]

In the electronic instrument of claim 1 and three publications,

The electronic instrument characterized by having covered said tank by said heat sink, and covering this heat sink in a display case.

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TECHNICAL FIELD

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[Field of the Invention]

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[0002]

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EFFECT OF THE INVENTION

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[Effect of the Invention]

According to this invention, the electronic instrument which adopted reliable liquid cooling can be offered.

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[Translation done.]



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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention]

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Although the above-mentioned conventional technique is effective in cooling of an electronic instrument, it needs to perform still more reliable cooling for cooling of the electronic instrument which may be thin-shape[ small and ]-ized increasingly from now on.

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The purpose of this invention is to offer the electronic instrument which adopted reliable liquid cooling.

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PRIOR ART

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In recent years, as for the electronic instrument, high generation-of-heat-ization of a semiconductor device is progressing as the demand of improvement in the speed or large-capacity-izing becomes high. JP,6-266474,A, JP,7-142886,A, etc. are raised as a cooling means corresponding to this raise in generation of heat.

[0003]

the body case which held the wiring substrate in which the electronic instrument indicated by JP,6-266474,A carried the heater element, and a display panel -- having -- a body case -- a hinge -- rotation -- it consists of a display case attached movable. A heat-receiving jacket is attached in a heater element, and the liquid which endoergic was carried out with this heat-receiving jacket, and got hot radiates heat from the heat dissipation pipe installed in the display case. It circulates through a liquid with the liquid drive attached in the middle of the piping path which connects a heat dissipation pipe with heat-receiving JAKKETO. Piping which connects a part for a hinge region serves as a flexible tube. Furthermore, JP,7-142886,A aims at improvement in the heat dissipation effectiveness by making the case of JP,6-266474,A into metal.

[0004]

Refrigeration capacity is high, and moreover these conventional techniques are excellent in silence, and more effective in cooling of an electronic instrument than forced cooling by the fan.

[0005]

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[Translation done.]